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Upgrading the industrial process flowsheet for the dehydration of methylbutenes to isoprene. II: Analysis of plant test results and industrial implementation of the upgraded design

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Abstract

© 2016, Pleiades Publishing, Ltd.Pilot tests of technology for the dehydration of methylbutenes to isoprene are performed in a tworeactor system with an additional supply of an overheated gas into the interreactor space. The tests are performed on a pilot plant with two adiabatic reactors. The total volume of the catalyst charge is 60 dm3, the temperatures are 565–620°C, the contact time is 0.18–0.25 s, the raw material is diluted with steam in a weight ratio of C5H10: H2O = 1.0: (6.0–30.0), and the excess pressure is 0.6–0.7 kgf/cm2. The dependence of the isoprene concentration in the contact gas on the heat energy supplied by the raw material and steam is determined under conventional conditions of the process and in a pseudo-isothermal mode via an additional supply of overheated gas into the interreactor space. It is shown that the isoprene yield is increased by 10–12% by using the upgraded mode. The conditions for conducting the industrial process are determined based on the obtained results. After upgrading the design, tests are performed at the synthetic rubber factory of PAO Nizhnekamskneftekhim on a plant for the dehydrogenation of methylbutenes in the reactor with a doublelayer catalyst bed (nine tons per layer). The patterns established during the pilot tests generally prove to be true, but the selectivity of the process is reduced due to a number of design flaws. Corrective measures are outlined. Comparison of the experimental results and the calculated values confirm the accuracy of the mathematical model.

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Keywords

dehydration of methylbutenes to isoprene, mathematical modeling, pilot tests, technological process design